Mr. J. R. Bovell (Barbados), in his papers on "Rotation and Catch Crops on Sugar Estates" and "Green Manuring as a means of Fertilising Cane-lands in the West Indies," illustrated by plants, seeds, tubercles, &c., brought forward useful information on the yields and values of food crops in Barbados, and the capability of sugar estates of self-support in regard to cattle food, and a useful *résumé* on the relative value of different leguminous plants. Mr. E. E. H. Thorne (Barbados), in "Silos on Sugar Estates in Barbados," gave a valuable account of actual results, and a number of useful practical hints. The Hon. F. J. Clarke (Barbados) and the Hon. Francis Watts (Antigua) gave a history for Barbados and Antigua of the efforts of the planters to erect central co-operative factories; both agreed as to the absolute necessity for improved manufacture if the industry is to survive, and as to the difficulty, so long as bounties last, in enlisting any but Government guaranteed capital, notwithstanding the certainty of a very profitable investment even at present prices.

The conference adjourned at 5 p.m., having devoted the entire day to subjects connected with the sugar industry.

A conference dinner was held the same evening at the Marine Hotel, at which about sixty guests were present. The following day, Sunday, afforded an opportunity of visiting the experimental stations, and a pleasant afternoon was spent at the "At Home" given by Mrs. Morris at "Chelston."

On Monday morning, at nine, the labours of the conference were resumed; the day was devoted to educational and general subjects. A long and important discussion took place upon measures for the inspection and treatment of imported plants in reference to plant diseases. The questions submitted were: Shall any or all of the following measures be adopted by legislative enactment?:—

(*a*) Total prohibition in certain cases.

(*b*) Inspection at port of entry, with power to destroy, quarantine or treat infected plants.

(*c*) Certificate from shipper declaring plants to be free from infection, countersigned by an inspector at shipping port; and while no definite agreement was come to, there was a consensus of opinion in favour of the Legislatures giving special powers to their respective Executives.

The papers read on educational subjects were: "Teaching Agriculture in High Schools and Colleges," by Mr. H. Deighton (Barbados) and the Rev. W. Caroll (Trinidad); "Teaching Agriculture in Elementary Schools," the Rev. J. E. Reece, Colonel Hicks, Mr. William Blair, Mr. Collens, Mr. Watkins and Mr. Hudson; "School Plots as Aids in Teaching Agriculture in Elementary Schools," Hon. W. Fawcett (Jamaica); "Experiment Station Work in Trinidad," Mr. J. H. Hart (Trinidad); "Aims and Objects of Experiment and Teaching Stations," Rev. Canon Simms (Jamaica). The subject of teaching agriculture in elementary schools was exhaustively treated. The paper by Canon Simms gave an interesting summary of observations on experimental stations and agricultural colleges in the United States of America and Canada during his recent tour, and very practical suggestions for higher agricultural teaching at Jamaica.

The Hon. Francis Watts, in his "Food Supplies of the Leeward Islands," gave a useful account of the food-growing resources of those islands; urged less importation of food-stuffs and more local production. He pointed out the close connection between cheap food and the abundant cheap labour so necessary in cane-growing countries, and brought forward evidence to show the "irrational" nature of the present diet, and how, by the proper combination of local products, it could be rendered "rational."

The Hon. William Fawcett (Jamaica) read an important paper on "Distribution of Economic Plants in Relation to Agricultural Development"; and other papers were read on "Steps taken at the St. Vincent Botanic Station for the Distribution of Seeds, Plants, &c., after the Hurricane of 1898," Mr. Powell; "Suggestions for Increasing the Usefulness of the Botanic Stations," Dr. Alford Nicholls; "Packing Seeds and Plants," Mr. J. H. Hart; "Bee-keeping in Jamaica," Mr. T. R. Doidge.

During the day the Chemical Section of the Conference presented a report upon uniformity in returning the results of field experiments on the sugar-cane, and upon some minor matters of detail.

A vote of thanks to the President, and the usual compliments, brought the conference to a close about 5 p.m. The representatives embarked the same night.

J. P. D'ALBUQUERQUE.

MODERN LIGHTHOUSE APPARATUS.

THE development of the modern system of lighthouse apparatus and illumination may be said to have originated in the mercury-float mechanism, devised in 1890 by the late M. Bourdelles, Director-General of the Central Lighthouse Service of France. Fig. 1 is a drawing of a lighthouse apparatus fitted with M. Bourdelles' mercury-float mechanism.

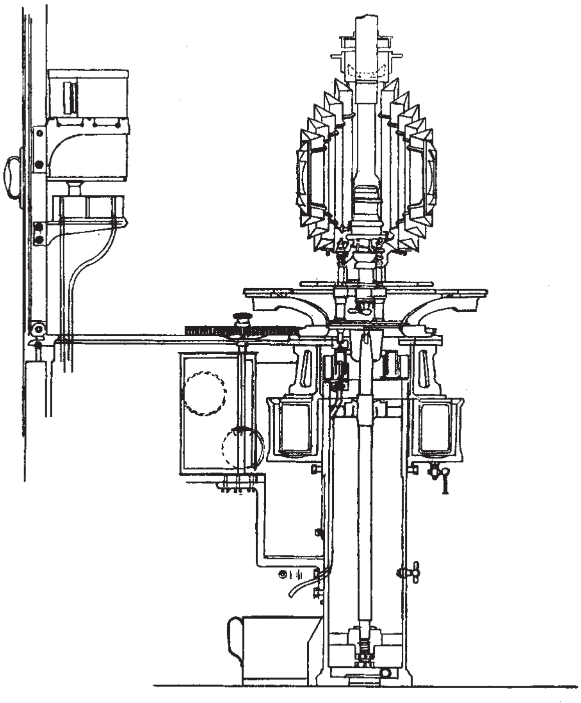

FIG. 1.—Feu-éclair. Third order apparatus. (Section.)

In place of the roller or ball bearings employed in the past for revolving apparatus, an annular trough is employed, in which there floats a second annular trough, on which is carried the dioptric apparatus. In order to steady the revolving superstructure, and to render it capable of a certain amount of adjustment, a vertical spindle projects downwards from the apparatus through the mercury trough to some distance below it, and is supported and guided upon suitable bearings.

Such is briefly the invention of the mercury-float mechanism, and it is clear that with only fluid friction to contend with, the revolution of the apparatus is rendered easy in the extreme, and that a speed and steadiness of revolution is obtained that was impossible with the older forms of apparatus.

Having devised an apparatus capable of such rapidity of revolution, M. Bourdelles was led to the conclusion that by reducing the number of sides in a revolving apparatus, and so allowing of an increased size, it would be possible, with the rapidly-revolving mechanism, to produce flashes of great power, following one another at as short intervals as had been done with the old many-sided apparatus, and hence arose the *feux-éclairs*, or lightning-flash lights, now so generally employed.

This system, it will thus be seen, makes use of dioptric panels of the greatest possible amplitude, which are revolved at a speed limited only by the duration of flash necessary to give to the eye of the mariner the full perception of the light emanating therefrom. In practice this was found to be about 1/10 of a second for lighthouse purposes.

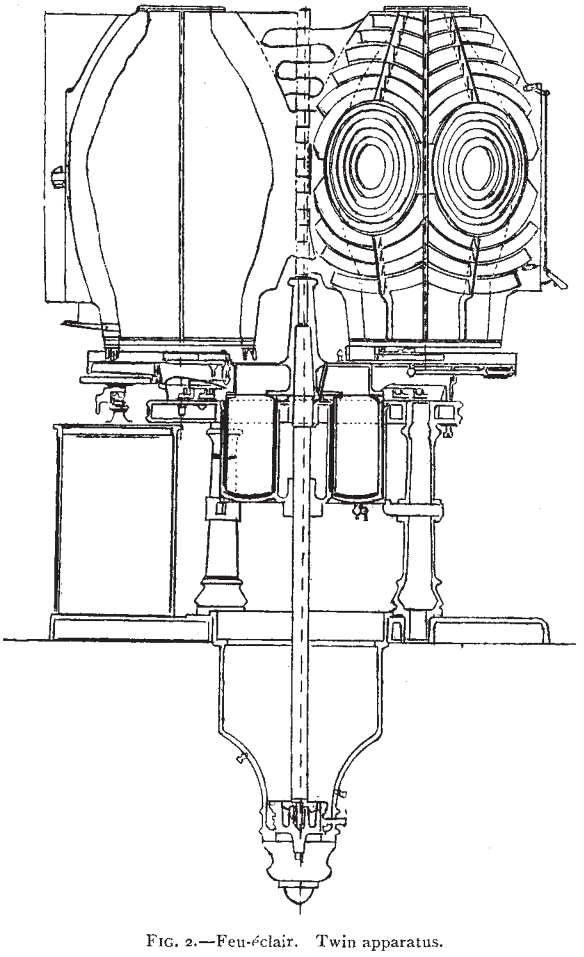

FIG. 2.—Feu-éclair. Twin apparatus.

The first mercury-float *feu-éclair* light which was established was that at Senetose, in the Island of Corsica, in the year 1890.

As a further advance in lighthouse apparatus, the twin mercury-float *feu-éclair* may be mentioned. Fig. 2 is a drawing of this apparatus. Here, instead of the superposed biform, triform or quadraform apparatus previously used, the two apparatus are placed side by side, and are so set that the flashes from one apparatus are parallel to those from the other, so that at sea the beams are in effect one.

Following upon the single and twin *feux-éclairs* of M. Bourdelles come the spindle-eclipser apparatus of the writer. In this system only one—or at most two—dioptric lenses or panels are used in conjunction with an eclipsing device which periodically obscures and discloses the light. Figs. 3 and 4 are drawings of a single panel-spindle eclipser. The action of this form of apparatus is best explained by an example.

Suppose a group-flashing light is required, each group having two flashes; all that is required is to so design the mechanism of the eclipser that it will eclipse the light after two complete all-round flashes, remain closed for the length of time desired for the long dark period between the groups, and then open just long enough to allow the two flashes to be seen once more, and so on *ad infinitum*.

In place of only one panel two can be used; but here it is necessary to have the eclipser in two halves, each of which is operated separately, so as to obscure in rotation the light from one panel and then the next.

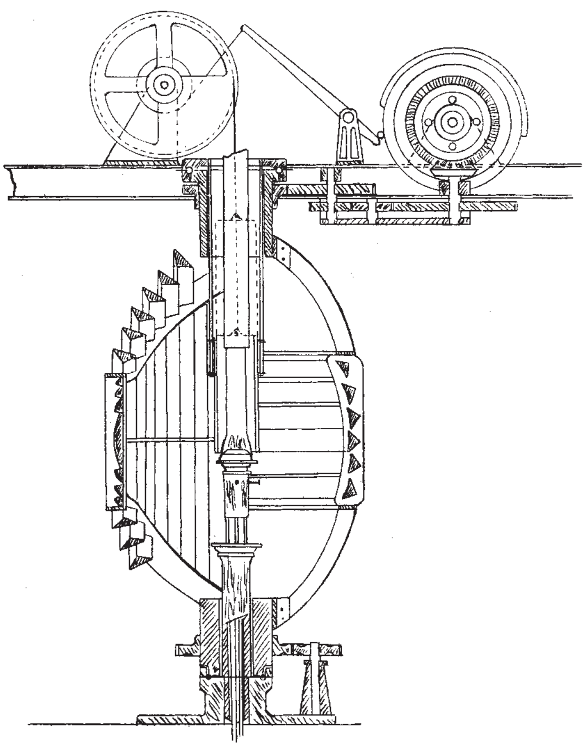

FIG. 3.—Spindle eclipsing apparatus. (Section.)

From what has been said, it is clear that with only one, or at most two, simple dioptric panels and an eclipse it is possible to produce all manner of group-flashing characteristics which in the past demanded the splitting up of the large panels into sections, from each of which a beam emanated. In the new system a complete panel, and that of the greatest possible amplitude, *i.e.* 180 in altitude, and azimuth can be employed, and consequently the most powerful flash is obtainable from this apparatus. As the apparatus do not need to be of large size, the method of mounting them upon upper and lower spindles has been employed merely to render their construction as simple as possible.

In addition to the improvements mentioned above, which deal with the actual lighthouse apparatus as a whole, there are the improved types of lenses for lighthouse apparatus recently invented by Mr. Charles A. Stevenson, which he has termed the equiangular refractor, and that of the writer known as the inverse equiangular.

With respect to the smaller classes of lights, there are the new permanent lights burning for some weeks without the attention of a keeper, which are largely used in the French Lighthouse Service. In these lights the upper portion of the wick is carbonised, so that no turning up or down thereof is necessary, and the supply of oil which feeds the lamps is of such a quantity and is so regulated that the lights burn without any attention whatsoever for many days.

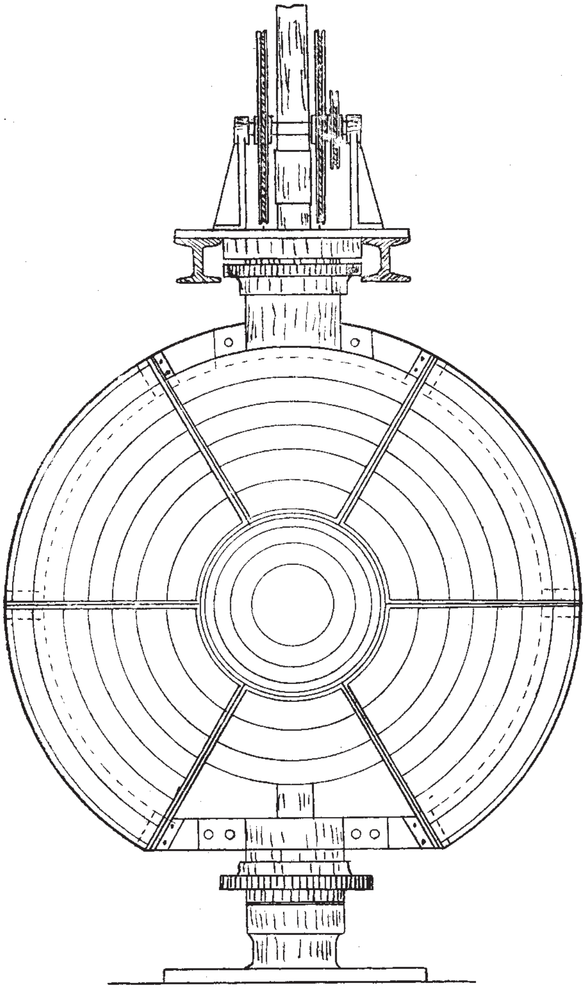

FIG. 4.—Spindle eclipsing apparatus. (Front elevation.)

J. A. PURVES.

MR. BALFOUR ON SCIENTIFIC RESEARCH.

A SPECIAL festival dinner of friends of King's College, London, was held on Wednesday in last week, with the object of directing attention to the want of new laboratories, especially laboratories for physiological and bacteriological research, and promoting the collection of funds to supply the need. Mr. Balfour presided, and he made excellent use of the occasion by advocating the fuller recognition of the value of scientific research, and increased opportunities for carrying on original investigations. The encouragement of scientific research is a national responsibility, which has hitherto not been adequately realised either by the State, by public bodies, or by private individuals. Mr. Balfour's remarks, reprinted below, from the *Times*, will serve to remind people of the influence of science upon national progress and prosperity, and may thus lead to a more liberal provision of resources for assisting the advancement of natural knowledge.

We have all of us, probably, been stirred, either in making speeches or in listening to speeches, in recent years on the subject of technical education—a very loose phrase sometimes used, or misused, to mean education in manipulation or dexterity of hand treatment; sometimes, and I think more properly, used to mean that application of science or of the principles of science to industrial life, which we are more and more beginning to recognise is the increasing need of the age in which we live. It has been found easy, and I hope it always will be easy, to enlist popular interest in anything so useful as the application of scientific method to industrial pursuits. It will be all the more easy because of the fact that we have before us in certain countries striking and admirable instances of the success which attends, or may attend, such application of scientific method to industrial pursuits. An appeal for that purpose is an appeal which touches the heart of everybody nearly or remotely connected with the industries on which this nation as a whole lives, and on which it must continue to live if it is to live at all.

I appeal for something not less necessary, though for something perhaps more remote from the ordinary everyday popular educational interest; for I appeal on the present occasion, not so much for anything in the nature of technical instruction or applied science as for aid to carry out that instruction in science itself and those researches in pure science which lie at the base of that instruction which, from the very nature of the case, can only appeal indirectly and remotely to the great mass of mankind. And yet, after all, science is the essential matter that we have got to consider; its applications will come and must come, will come almost of themselves, must come in the course of time; but you cannot have applied science without having science in the first instance, and if you do not cultivate scientific research and scientific education, it will be in vain that you multiply your technical classes, it will be in vain that you labour to erect a great superstructure where your foundations have been so inadequately laid. I feel it the more incumbent upon me to urge upon you the claims and the glories of science pursued for itself from the fact that they cannot directly appeal to the general interest of the mass of mankind. We ought not to wonder, we ought not to criticise, and we ought not to be surprised that, among the great number of persons deeply interested and astonished at, for example, anything so interesting and sensational as wireless telegraphy, few remember the inventions which have made that telegraphy possible; they neither know of nor take interest in the investigations of a Maxwell or the experiments of a Hertz, which, after all, are at the base of the whole thing, without which any such discovery as wireless telegraphy would not have been possible, but who, as discoverers, had fame and recognition among scientific men capable of understanding their work, yet who have not, perhaps, even now that world-wide reputation, that currency in the mouths of men, which fall to inventors much less than themselves, who have properly built their work on the foundations laid for them by others. Yet to my view it is the bounden duty of every great place of University education that they should keep before them not merely the immediately practical needs of technical or other education, but that they should never permit the ideal of University investigation to be for one moment clouded in their eyes, or to lose interest, or cease to be the object of worthy effort and endeavour.

But that great object must increasingly, in my judgment, require the generous and liberal co-operation of all classes of the community, whether they be immediately interested in science, intimately acquainted with scientific details, or whether they be merely part of the general public. Men of science themselves are not always in a position to give that pecuniary aid necessary to establish the modern laboratory and to equip it with modern appliances; and they are right to call upon all those who take any interest in their subjects to aid them with that pecuniary assistance which in some other countries—many other countries—is extended to them by the Government, but which in this country, rightly or wrongly, by an almost immemorial